BEFORE THE

Federal Communications Commission

RM-7927

In the Matter of

CELSAT, INC

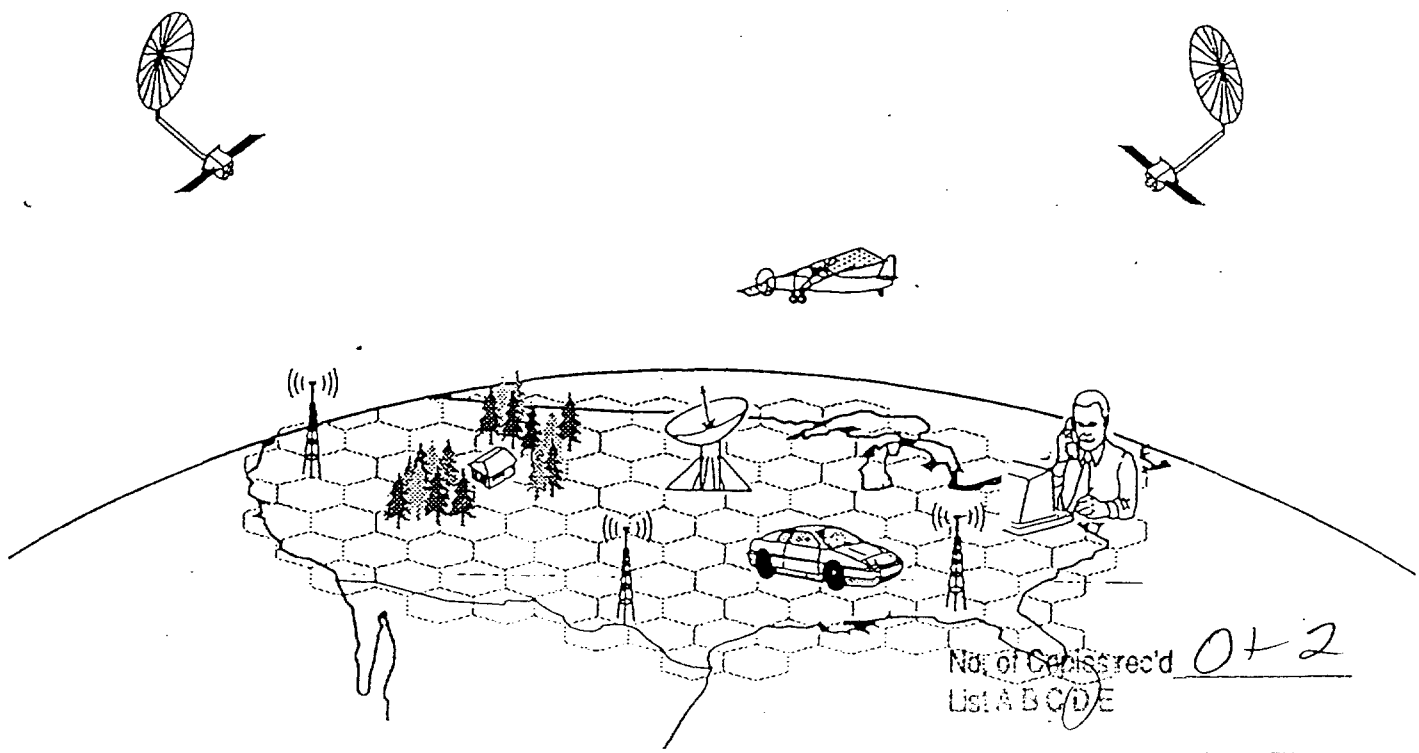
Request for a Pioneer's Preference
Regarding Its Petition for Rulemaking
to Allocate Spectrum and To Establish
Rules and Policies for a New Hybrid
Personal Communications Network Service

RM-7927

Docket No. _____

REQUEST FOR PIONEER'S PREFERENCE

CELSAT



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OFFICE OF THE SECRETARY

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REQUEST FOR PIONEER'S PREFERENCE

CELSAT, INC., ("**CELSAT**"), by its attorney and pursuant to Commission Rule Section 1.402 (47 C.F.R. §1.402), hereby respectfully requests the Commission to grant **CELSAT** a pioneer's preference for its proposed *Hybrid Personal Communications Network* service concept ("HPCN") disclosed in its Petition For Rulemaking filed on February 6, 1992.[1] **CELSAT** submits that the effort, innovation and creativity reflected in its HPCN concept and design personify the best in what the Commission hoped to stimulate under

[1] See, *In the Matter of AMENDMENT OF PARTS 2, 22 & 25 OF THE COMMISSION'S RULES for an Allocation of frequencies and Other Rules for a New Nationwide Hybrid Space/Ground Cellular Network for Personal/Mobile Communications Services*, filed by **CELSAT, INC.**, February 6, 1992, hereafter "Petition".

its *Pioneer Preference Order* and, as such, deserves recognition in the form of a pioneer preference award.[2]

SUMMARY

CELSAT, INC., a California corporation based at 3033 Science Park Road, San Diego, California 92121, has requested the Commission to initiate a rulemaking to support a new class of mobile telephone service which affords a quantitative and qualitatively new standard of service to the mobile communications user. This generic concept is referred to in the Petition and throughout this request as a *Hybrid Personal Communications Network* ("HPCN"). The Commission also has been asked to allocate at least one band pair of either 32 or 37 MHz in either the S-Band or L/S-Band on an exclusive, primary basis for an HPCN and associated personal/mobile voice, data, video and position determination services. **CELSAT** also will soon be filing applications for experimental authority to construct a ground segment system and for authority to construct and launch an HPCN satellite as the first of two to be deployed as part of a permanent, nationwide HPCN system and service to be known as **CELSTAR**.

CELSAT's **CELSTAR** system is, to **CELSAT**'s knowledge, the first instance of such an HPCN -- a pioneering example of the feasibility of the HPCN concept. **CELSTAR** heralds a new era in efficient, low cost high capacity personal/mobile telecommunica-

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[2] *Establishment of Procedures to Provide a Preference to Applications for New Services*, 6 FCC Rcd 3488 (1991) ("*Pioneer Preference Order*").

tions, and already amounts to a major leap over the concept plans for its closest functionally equivalent alternative, Future Public Land-Mobile Telecommunications Systems ("FPLMTS").[3] **CELSTAR** is a truly integrated space/ground cellular network system, designed from the ground up to take maximum advantage of the very flexible and powerful service opportunities uniquely afforded by HPCN.

As shown below, HPCN is not only in the public interest but is especially deserving of a Pioneer's Preference because:

- **It extends the proven benefits of ground cellular service to a vast new population not presently served;**
- **It maximizes the reuse of the satellite spectrum over the U.S. (more than 100 times), and is extraordinarily spectrum efficient (up to 1900 VG space circuits/MHz);**
- **It provides dynamic reallocation of service capacity, in space and time, between the various satellite and ground service elements which further increases spectral efficiency by second order of magnitude;**
- **Such dynamic reallocation capability provides a new responsiveness to local or national emergencies;**
- **It promises the greatest variety of personal/mobile services at the lowest price (less than 25¢/min. per VG circuit) to the largest number of users (10-30 million subscribers);**
- **It's geosynchronous satellite will provide continuous, uninterrupted and ubiquitous coverage over the entire U.S., Alaska, Hawaii, and Puerto Rico/Virgin Islands, total redundancy over CONUS, and can be deployed quickly;**

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[3] FPLMTS contemplates end user access from personal and mobil stations on land, sea or in the air to a worldwide combined terrestrial/satellite system. Unlike HPCN, however, FPLMTS requires considerably more bandwidth and four different frequency bands for communications between personal, mobile and pager stations to fixed/mobile earth stations and for communications between the satellite. This is illustrated in the schematic appended as EXHIBIT 1 hereto, which was recently published in an article entitled "Special Report - Mobile Communications", *IEEE Spectrum,* February, 1992, at p. 27. Most significantly, **CELSAT**'s HPCN offers all of the same functionality using one frequency band, no dual-mode switching required between subbands, and it can be deployed worldwide -- indeed, it is **CELSAT**'s intention to seek additional authority to do so.

- **It will generate new jobs and commercially viable market opportunities for many different suppliers of devices and various supporting infrastructure systems and components, and a new level of wireless competition;**

- **It will support wideband synchronous and asynchronous data, multimedia and compressed video, and other "intelligent" services and features at variable bandwidth on demand, up to 144 kbps; and**

- **It offers the only seamless, nationwide, intelligent space/ground wireless network for "one number" personal/mobile voice, data, position determination and other information services.**

CELSTAR and HPCN is, as shown in its Petition, inherently a nationwide system and service which does not lend itself to a quilt of multiple providers on a shared spectrum basis. However, as **CELSAT** has further proposed in its Petition, the Commission could allocate multiple HPCN paired spectrum bands and thereby authorize more than one HPCN provider. Or, as **CELSAT** contemplates in its own application, HPCN capacity in any one system should be sufficient to permit a form of "pseudo spectrum sharing" with other providers on an IRU-like basis.

CELSAT's HPCN proposal clearly meets the Commission's eligibility criteria for a Pioneer's Preference.[4] Accordingly, **CELSAT** requests a preference for a nationwide HPCN license.

* * * * *

[4] 47 C.F.R. §1.402. Briefly, the Commission's eligibility criteria, as recently applied, require that the applicant (1) demonstrate that its proposal is technologically innovative; or (2) that such an innovation will lead to the establishment of service not currently provided or will substantially enhance an existing service. See Commission's action in ET Docket 91-280, tentatively granting a Pioneer's Preference to Volunteers in Technical Assistance (VITA), January 16, 1992.

I. INTRODUCTION

CELSAT, Inc. is a relatively new pioneer, a vanguard in the emerging field of high capacity, high speed personal/mobile digital communications using spread spectrum code division multiple access coding ("SS CDMA" or "CDMA"). **CELSAT** was formed, for among other purposes, to develop certain principal resources -- (1) a wealth of technical expertise in the planning, design, system engineering, and system testing of large scale aerospace systems and associated launch services; (2) a design for the essential CDMA elements which make it possible to reuse a single spectrum block in a super high capacity hybrid space/ground cellular-like telecommunications network; and (3) certain related patent rights.[5] **CELSAT** desires to construct and operate an innovative and extremely spectrally efficient *Hybrid Personal Communications Network* which combines the best of mobile satellite and ground-based cellular and other wireless technologies and capabilities. The system which **CELSAT** proposes will:

- Achieve a new standard of spectral utilization and efficiency -- over 55,000 voice circuits serving the U.S. in the first generation space subsystem alone; ultimately, about 700,000 additional ground-cell circuits. This space-only capacity exceeds competing systems by an order of magnitude, and by two orders of magnitude if the ground capacity is included.

- Require only a single, very light-weight (4-7 oz), minimum battery power transceivers (0.1 W avg.) in either satellite or ground mode, thereby ensuring long battery life and relatively low cost.

- Utilize a large, high gain antenna to provide the smallest possible, multibeam footprints.

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[5] **CELSAT** holds the patent rights to U.S. Patent 5,073,900, issued to Albert J. Mallinckrodt, one of **CELSAT**'s founders, for an *INTEGRATED CELLULAR COMMUNICATIONS SYSTEM*.

- Utilize fixed position, geosynchronous orbits to ensure stable, low cost and predictable coverage, integratable with ground elements.

- Utilize the emerging CDMA ground cellular standard.

- Offer a graceful, evolutionary deployment scheme allowing HPCN to circumvent saturation, degradation in service quality and excessive levels of satellite signal delay by subdividing and otherwise expanding space-cells into ground-cells incrementally as demand and other service requirements warrant.

This powerful technology and concept, and the services which they will bring, are so novel and innovative that they are not specifically accommodated by any existing spectrum allocation or elsewhere in the Commission's rules. **CELSAT** has identified at least two spectrum bands which could accommodate an HPCN very efficiently. One at S-Band consists of 37 MHz of the 80 MHz which the Commission has recently recommended for generic mobile satellite services (MSS) at the WARC 92 conference;[6] the other is 32 MHz of the L/S-Bands currently allocated for domestic RDSS services.[7] In its petition **CELSAT** requested that the Commission allocate at least one of these band pair for HPCN purposes.

II. CELSAT'S PROPOSED *HYBRID PERSONAL COMMUNICATIONS NETWORK ("HPCN")* CONCEPT AND CELSTAR SYSTEM

CELSAT is seeking a license to use certain spectrum in a way in which no commercial spectrum has been used before -- namely, in a *hybrid* super high capacity space/ground cellular-like personal/mobile system in which end user communications will be transparent to either the space- or the ground-cells while

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[6] See, *An Inquiry Relating To Preparation for the International Telecommunications Union World Administrative Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum*, Gen. Docket 89-554, 6 FCC Rcd. 3900, released June 20, 1991.

[7] A HPCN system could also be operated in at least part of the 220 MHz between 1.85 GHz and 2.2 GHZ recently recommended for reallocation to new services, such as PCN. See, FCC News Release, January 16, 1992, ET. Docket No.92-9.

operating within the same common frequencies. The tremendous spectrum reuse made possible by this concept, coupled with CDMA with FEC coding, further allows the spectrum to be used for new multipurpose digital communications at variable bandwidth up to at least 144 kbps.

A. HPCN Definition and Scope of Service

Recognizing a hybrid system from any other mobile satellite proposal should not be difficult. But in the future it will become necessary to distinguish a true HPCN from less efficient *simulated* HPCNs. For this purpose **CELSAT** has proposed to the Commission an appropriate definition for a true "*hybrid personal communications network*":[8]

Definition:

> *Hybrid Personal Communications Network.* The term Hybrid Personal Communications Network ("HPCN") refers to an integrated combination of high capacity, very spectrally efficient (at least 1000 5 kbps space channels/MHz) space- and ground-cellular systems capable of:
>
> a. Satellite personal/mobile communications and position determination service coverage over the continental United States
>
> b. Ground cellular personal/mobile and position determination service coverage within space cells
>
> c. Space/ground communications in compatible spread spectrum CDMA format with forward error correction (FEC) encoding

[8] Petition at pages 39-40.

d. Transparent and integrated transfer of communications from cell-to-cell and between space/ground-cell types

e. A wide range of personal/mobile digital communications and position determination services, including high speed bit rates

f. Such communications capability must be able to use all subbands within the same contiguous HPCN allocation

g. Dynamically redistributing portions of the subbands within all of the allocated spectrum as well as other resources alternately between space and ground segments as needed to accommodate changing load and service requirements.

In addition, **CELSAT** has proposed that the scope of service permitted under licensed HPCN operations should be broad and flexible, to reflect its tremendous capacity and variable digital characteristics, as well as the changing marketplace requirements for more data-oriented and combined voice/data/ position determination, compressed video and multimedia wireless capabilities.[9] This freedom should resemble the latitude afforded by the following:

Definition:

Hybrid Personal Communications Network Services. Permit-ted HPCN services include any digital one-way or two-way communications of voice, data, video, image or position determination informa-tion originated or terminated over a hybrid personal communications network to or from either a portable, mobile, or special-purpose fixed terminal or transceiver operated at low power with unswitched low gain antenna for either point-to-point or point-to-multipoint personal, business, commercial or public safety purposes over land, air or water.

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[9] Id., at p. 41.

B. The Hybrid Personal Communications Space/ Ground Network ("HPCN") Design Promises 21st Century Wireless Communications Through Innovative Use of 20th Century Systems and Technology

The system architecture necessary to achieve HPCN's performance is unique and, to CELSAT's knowledge, has never been previously proposed. This configuration of high technology elements, currently available only in the United States and first recognized by CELSAT, results in superior performance, seamless communications, low cost and other functional capabilities heretofore not attainable. Other configurations might be feasible, but CELSAT has no knowledge of any that would be as well suited to a super high capacity HPCN.

The key elements to a working HPCN system include the combination of:

(1) a large, unfurlable high gain antenna (i.e., 20 meters) with over 100 image feeds;

(2) use of geostationary orbits;

(3) spread spectrum CDMA technology with forward error correction (FEC);

(4) low power, omnidirectional transceivers;

(5) a high degree of power and frequency coordination using a network controller; and

(6) associated ground system elements.

An overview of the **CELSAT** HPCN system components is included as Appendix A to **CELSAT**'s Petition, and, coupled with the other appendices thereto, helps provide convincing evidence of HPCN's complete feasibility.

C. An HPCN Satellite System Will Offer Huge Capacity For Seamless Personal/Mobile Wireless Communications

Using the 37 MHz proposed in S-Band an HPCN operated in just the space-only mode can attain up to 56,000 space-based VG circuits, all over the United States; with only 32 MHz from the requested L/S-Band it can attain 60,900 U.S. circuits. This tremendous space-cell capacity *alone* will allow new and heretofore unavailable mobile services to be offered which otherwise would be neither technically nor economically feasible using systems lacking such capacity.

However, the HPCN is not intended to be operated in a space-only mode. HPCN spectral subband capacity can and should be flexibly and dynamically apportioned between space and terrestrial operating modes, depending on demand, quality, grade of service desired, and geographic location. If, as anticipated in **CELSAT**'s application, about 7% of the total HPCN subband capacity were used terrestrially it would allow for up to 700,000 additional ground-based VG circuits.[10] This level of potential ground-cell capacity ensures that both new and existing services will be available at heretofore unattainable low cost to the end user -- both in terms of fixed terminal costs and usage charges.

The *hybrid* or HPCN communications concept utilizes both mobile satellite and ground cellular technologies. It promises the

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[10] The satellite or space-cell capacity, on the other hand, would be reduced just slightly, to nominally 55,000 VG circuits. Also, this number assumes an S-Band allocation of 37 MHz. The number of available satellite channels would be correspondingly higher under the proposed L/S-Band request.

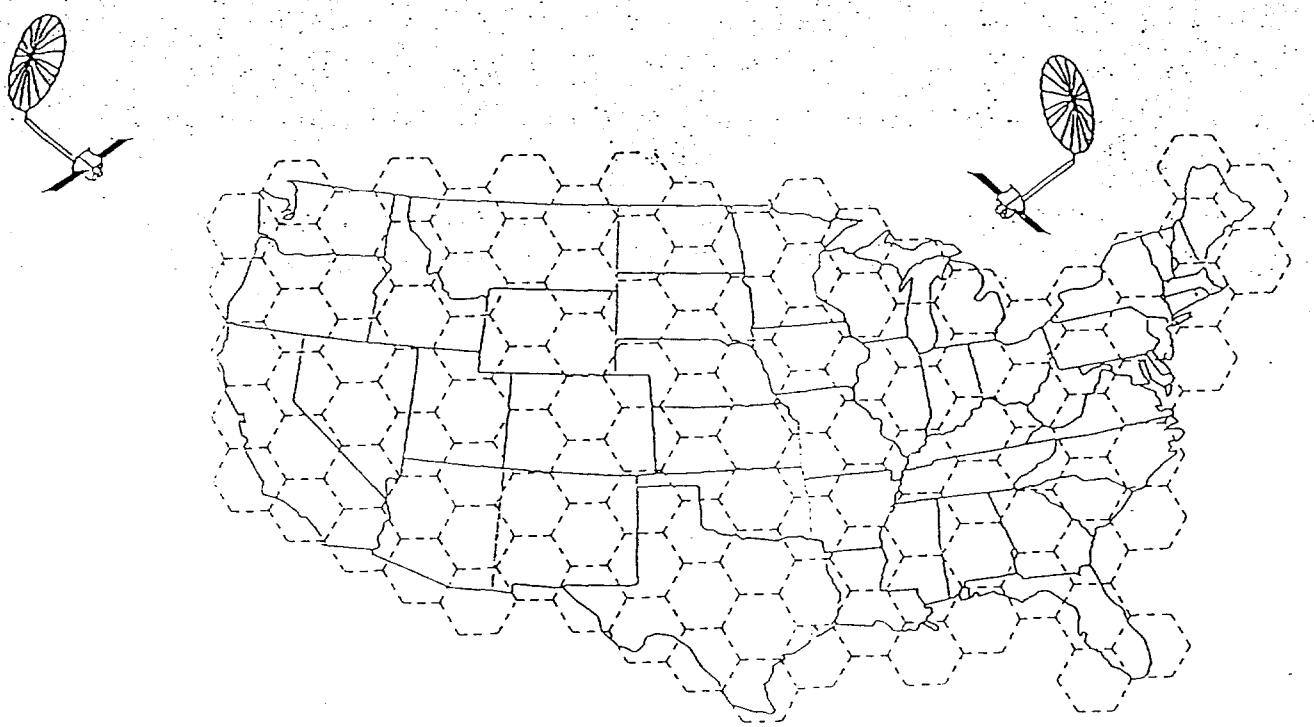
widest array of seamless, nationwide voice, data, position determination, compressed video and other imaging capabilities possibly attainable from one single service network. But again, what is important is that **CELSAT**'s HPCN has the shear capacity to make such services commercially viable and widely available to the greatest number of users, thereby stimulating U.S. opportunities in the emerging worldwide industry of personal/mobile *information* communications.

D. HPCN Employs A Unique Overlapping Configuration of Space-/Ground-Cells

As shown schematically in **FIGURE 1**, HPCN reuses the same frequency spectrum in a configuration of overlapping space-cells and ground-cells. The "tightness" and directionality of the space-cells ensures 100% ubiquitous geographic coverage with very high end-user capacity. The ground-cells, which are confined by the space-cell beam coverage, allow for even much higher capacity in the same geographic area. Using the same handset or other portable/mobile device, and without switching from one mode to another, an end user can initiate or receive a call to or from any destination using either a space-cell or, where available, a ground-cell channel.[11] Similarly, the user can move readily between

[11] It has been recently announced that both AMSC and Motorola are proposing that the terminal devices to be used with their respective proposed MSS systems will be able to operate in a dual mode (using a mode switch) so as to communicate with either their respective satellite services or a compatible ground cellular service. Other applicants, including TRW and Ellipsat, have also indicated a potential compatibility with ground-based CDMA services using dual mode devices. It should be understood that what CELSAT is proposing is not a system requiring a "dual mode" device but one system in which the device operates automatically with either space- or ground-cells. HPCN devices will be operated under the

ground-cells, between space-cells, or from ground-cell channels to space-cell channels (and vice-versa) and be "handed off" from one to the other with no perceptible interruption in signal. HPCN thereby overcomes several of the significant disadvantages of existing ground-based cellular and other mobile systems -- namely, gaps in coverage, blocked and dropped calls.



HPCN SPACE-CELL OR "FOOT PRINT"
CONFIGURATION USING LARGE ANTENNA

FIGURE 1

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influence of a network controller and will use the same frequency band for both space- and ground-cell use. With HPCN, dual mode switches and circuitry will not be necessary. But it will be possible, if desired, to make HPCN devices also compatible with other CDMA-based wireless systems using a dual mode operation.

E. An HPCN System Permits Dynamic, Selective Apportionment of Satellite Spectrum for Use In Even Still More Efficient Ground-Cells

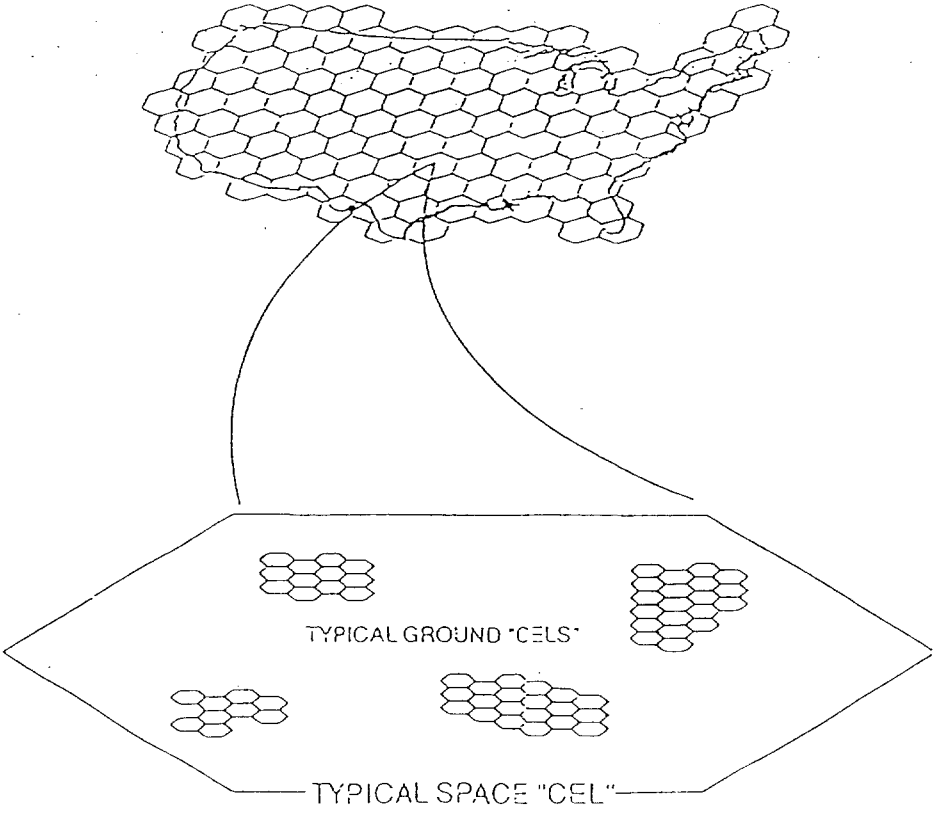
Next to its shear capacity, herein lies another of the distinctive and innovative features of the *hybrid personal communications network* concept -- the ability to reuse the same spectrum in both a space- and ground-based operating mode.

Each HPCN space-cell can reuse the full amount of the same satellite spectrum allocation. But in any or all space-cells the spectrum can be further apportioned on a space-cell-by-space-cell basis for use in a conventional ground-based cellular-like system. The redistribution results in only minimal reduction in the number of satellite circuits available in the affected space cell(s).

Specifically, for an S-Band HPCN configuration (e.g., using 37 MHz), the spectrum allocation in each space-cell could be divided into 14 communications subbands of 1.25 MHz each. Each subband, in turn, would have a capacity of approximately 36 equivalent digital VG channels, for a total of about 507 such channels per space cell. Any number of the 14 individual space-cell subbands could be apportioned selectively via a network controller for ground-cell use on an as-needed basis. For each space-cell subband so apportioned the same 1.25 MHz of spectrum will yield the equivalent of 59 VG circuits when used with a terrestrial subsystem, or 61% more capacity per subband then is possible in the space-only mode. The net reduction in space-cell satellite capacity is less than 2%. In geographic markets where

ground-cell capacity will not be needed (expected to consist of approximately 50% of the space cell coverage areas), the full 100% of the subbands would continue to be used 100% of the time for space-cell communications at maximum space-cell capacity.

The total capacity of the ground-cell system within each space-cell can be increased simply by further subdividing or expanding the number of ground-cells within the coverage area. *What is important, however, is that each additional ground-cell reuses the same space-cell subbands apportioned for ground use.*



HPCN GROUND-CELLS DISPERSED THROUGHOUT SPACE-CELL

FIGURE 2

The number of ground-cells deployed in any space-cell will vary depending on the population and/or market characteristics of the corresponding space-cell coverage area. While the terrestrial HPCN capacity is theoretically very high, **CELSAT** has projected a potential in-service ground-cell deployment in excess of 700,000 equivalent voice grade circuits by the end of the satellites' design life. This is *additional* system capacity, in excess of the nominal 55,000 satellite space-cell circuits described above.

Ground-cells are the key to meeting the high volume demand for personal/mobile communications in major urban and larger population centers or space-cell "regions".[12] In addition, *ground-cell communications will not experience a quarter second delay transitting through the satellite* and therefore quickly will become the preferred mode for predominantly voice transactions.[13] HPCN ground-cell capability could be developed contemporaneously with the construction of the HPCN satellites allowing a number of ground-cell systems to be in place and operational by the time the

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[12] **CELSAT**'s proposed HPCN design contemplates that space-cells will be "clustered" in groups of up to ten cells each, corresponding to the maximum number of space-cells to be served by a ground-hub and regional network controller. Such clusters generally will overlay the major metropolitan market areas of the country, and thereby will serve as natural, logical regional service boundaries for defining the breadth of the corresponding ground-cell markets. HPCN communications within such "clusters" will be treated more-or-less as very large "local exchange area" communications.

[13] Ordinary voice communications transitting a GEO satellite, including the HPCN space-cells, experience an approximately one quarter second delay which is perceptible to most users. To the extent, however, that voice users are routed over ground-cells they will not experience this delay phenomenon. **CELSAT** expects that, in time and except in rural or remote areas, the space segments will be used predominantly by non-voice transactions for which the satellite delay presents no problem.

space-segment is launched, or even slightly before.[14] Thereafter, ground-cell systems will be deployed as demand for additional capacity and higher quality voice communications dictate, and ultimately will account for the vast bulk of the HPCN system capacity.

F. An HPCN Will Use Very Light-Weight, Low Power Terminal Devices For Many Different Voice, Data, Multimedia and Position Determination Functions

An HPCN such as proposed in **CELSAT**'s application will utilize CDMA spread spectrum technology and will make maximum use of the best that that technology promises for the mobile market. Personal/mobile transceivers will be correspondingly small and light-weight (handheld, pocket-sized), and will operate with very low power consumption -- 0.1 Watt average for a VG circuit communication via a satellite, less when communicating over a ground cell.[15] In addition to conventional personal/mobile voice, paging and messaging, and position determination services, the HPCN will be used heavily with wireless laptop, notebook, palmtop and pen-based personal computers, video and other special-purpose fixed, mobile and portable terminals. Many transceivers will be customized with special features and enhancements for making use of

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[14] As noted above in the context of the HPCN system redundancy and backup characteristics, the space- and ground-cell systems can be operated independently of each other, such as in the event of a satellite or ground-based failure. In fact, although the full benefits of the HPCN system would not be realized, it is feasible to begin limited ground system service even before the satellites are deployed. **CELSAT** intends to demonstrate this as part of its request for experimental license authority which it will file shortly.

[15] This compares to today's analog handheld phones which operate at about 0.6 Watts, which accounts for their short battery life.

CELSAT's broad selection of available functions, selectable bit rates, and its adaptability to special market applications.

Moreover, because the same frequency bands and CDMA coding will be used by both space- and ground-cells, user terminals will communicate in a single mode, with complete continuity between hand-offs from one cell-type to another. HPCN will not require dual mode, switchable devices to communicate via satellite or terrestrially.[16]

There is no present, pending or even proposed radio-based system which even comes close to working with the breadth of new generation personal communications, navigation, information and display device technology as **CELSAT**'s HPCN. **CELSTAR**'s ability to accommodate new services and enhance existing ones will be proportional to the types and variety of the devices themselves.

III. A HYBRID PERSONAL COMMUNICATIONS NETWORK IS NEEDED TO MEET GROWING MARKETS FOR MOBILE SATELLITE AND GROUND CELLULAR/WAN/PCN COMMUNICATIONS SYSTEMS AND SERVICES

The HPCN concept offers a technically and economically feasible solution to many application and end user requirements for wireless personal/mobile communications which are presently either grossly under served, very costly to serve, cannot totally be served by one licensee/provider, or for which, without HPCN, stand no chance of being met.

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[16] Id., n. 17. On the other hand, HPCN devices could be compatible with many other CDMA-based wireless services, even operating in different frequencies, provided the device was equipped for dual mode operation.

A. There Exists Both Unmet Needs and Enormous Public Demand for Low Cost, Wireless Personal Communications

CELSAT's HPCN proposal and its **CELSTAR** design have been inspired by both the successes and the shortcomings of popular contemporary wireless technologies, including conventional mobile satellite and cellular telephone, and the emerging personal communications and wide area data networks ("PCNs" and "WANs"). HPCN offers a practical solution to the conflicting problems of spectrum shortages and escalating demand for low cost, wireless personal/mobile communications; it might offer the only technically feasible solution to the emerging needs for wireless high speed data and multimedia applications.[17]

The continuing and seemingly unsatisfiable demand for conventional cellular services, alone, is indisputable -- the need for more and improved personal, portable and mobile cellular services is growing, with no end in sight in many markets.[18] As the many applications for mixed-use and even single purpose RDSS, voice and data mobile satellite services unanimously attest, there exists a similarly undisputed demand for even basic mobile voice and RDSS

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[17] See, "REPORT OF THE BELL COMPANIES ON COMPETITION IN WIRELESS TELECOMMUNICATIONS SERVICES, 1991", filed in *United States v. Western Electric Co., Inc. et al.*, Civ. Action No. 82-0192 (MFJ Proceeding), October 31, 1991 (hereafter "Bell Report").

[18] Id.; also, "State of the Cellular Industry", Cellular Industry Telephone Association (CTIA), August, 1991; and *Amendment of the Commission's rules to Establish New Personal Communications Services*, Gen. Docket No. 90-314, *Policy Statement and Order*, released October 25, 1991, 6 FCC Rcd. 6601.

services in certain applications for which satellite technology offers the only satisfactory solution.[19]

As for the shortcomings, each planned or existing wireless personal/mobile system and/or technology has one or other major disadvantage. For example, both the proposed mixed-use MSS/RDSS mobile satellite systems and existing ground cellular telephone systems fall far short of the capacity needed to satisfy even existing demand, let alone the more contemporary requirements anticipated for later this decade and on into the early 21st century. Current wireless transmission and/or multiplexing schemes either permit only packet-type data transfer, or otherwise lack the continuity necessary for high speed transactions. None of the emerging ground-based technologies offers ubiquitous coverage; conventional cellular cannot offer privacy; satellite-based paging cannot offer voice communications or significant other information delivery; neither cellular nor PCN offers position determination; initial PCN systems will only originate communications and cellular

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[19] See,e.g., pending satellite applications of Motorola Satellite Communications, Inc., File No. 9-DSS-P-91(87), CSS-91-010; Ellipsat Corporation, File No. 9-DSS-P-91(87), CSS-91010; AMSC Subsidiary Corporation, File No.'s 1625/1626 DSS P/L-85, et al., Amended DSS-MP/ML-91(2); and also the MSS/RDSS applications of Constellation Communications, Inc., Loral Cellular Systems, Corp., and TRW, Inc. See, also, In the Matter of Amendment of Section 2,106 of the Commissions Rules to Allocate Spectrum to the Fixed Satellite Service and the Mobile Satellite Service for Low Earth Orbit Satellites, RM 7334,-7399, and -7612. The Commission has recently expressed a policy favoring PCN personal wireless development, Notice of Proposed Rule Making, ET Docket No. 91-280 (FCC 91-305) released October 18, 1991, 6 FCC Rcd. 5932. It's agenda continues to be ladened with yet other new proposals for wireless information transfer. See, e.g., Petition of Video/Phone System, Inc., for 1000 MHz for video, voice and data services, Telecommunications Reports, Vol. 58, No. 3, pp. 19-20, January 20, 1992; Petition For Rulemaking, Suite 12 Group, for a reallocation in the 28 GHz band for Multichannel Local Distribution Service filed September 24, 1991; Petition For Rulemaking, "Data-PCS", RM-7618, Apple Computer; and Petition For Rulemaking, Now Nationwide Wireless Network Service, Mobile Telecommunications Technologies, Corporation (MTEL), filed November 12, 1991.

subscribers cannot automatically receive communications while outside their home system area; both MSS and ground cellular systems are expensive to use; neither conventional cellular nor MSS can reliably transmit asynchronous data or data at bit rates above 9600 bps; and ground cellular suffers from frequently dropped and blocked calls, and noise interference. These are among the most significant problems -- all of which can be cured with HPCN.

Finally, while spread spectrum code division multiple access (SS CDMA or "CDMA") technology would bring substantial relief to cellular's privacy and capacity problems, the cellular industry has yet to recover its investment in analog systems and is therefore not anxious to change. Those systems facing capacity shortages will not wait for the newer CDMA technology. Meanwhile, the only fully endorsed industry digital standard is TDMA.[20] There is still a significant probability that the industry ultimately will split its system conversions between TDMA, CDMA and yet other alternatives including NAMPS. As a result, at worst, CDMA might be passed over as the cellular technology of choice; at best, it will be adopted in only a fraction of the nation's cellular systems resulting in either a high degree of incompatibility or the need for expensive dual mode transceivers.

Several of the proposed mobile satellite service applications, on the other hand, plan to use CDMA, but their respective system designs lack sufficient capacity to achieve

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[20] See, CTIA "Cellular Industry Report", Vol. 7, No. 12, p. 2, December, 1991.

maximum cost effectiveness in terms of their ability potentially to reduce the cost of handsets and supporting infrastructure components.[21] While deployment of CDMA in PCN networks could possibly ensure a role for CDMA technology, the capital intensiveness required to achieve satisfactory coverage in stand-alone PCN systems leaves its economic viability yet to be proven.

Together, these trends and developments substantiate **CELSAT**'s position that many present and near future personal/mobile services and market applications -- are destined to remain underserved or go unserved, due either to the lack of coverage, capacity, or functionality of the existing or proposed alternative systems. On the other hand, these requirements could be met very efficiently by one super high capacity, *hybrid* space/ground CDMA-based digital telecommunications network capable of a broad range of data rates and functions. **CELSAT** has designed such a system, and hopes to be authorized by this Commission to construct and operate it.

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[21] It has been projected that the price of other CDMA-based and similar handheld and other portable special purpose transceiver devices for alternative proposed systems will range between $1,200 - $3,500. In contrast, **CELSAT**'s tremendous capacity and subscriber base will permit very efficient, large volume production of basic and special-purpose user devices which should bring terminal costs down to well under $500 per basic unit. To the extent that existing cellular systems convert to CDMA and thereafter require CDMA-compatible terminals there is no reason to believe that cellular customer handsets will cost any less than those for HPCN -- in effect, cellular customers will pay just as much for a device that gives them less service.